Space Weather Technical Forecast

Issued on Tuesday, 16 July 2024 at 01:24 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: M-Class flares Likely (R1-R2 radio blackouts).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate, with a triple-peak M2.7 flare at 15/0937 UTC originating from AR3738. There are now up to sixteen sunspot regions on the visible disc. The largest and most complex region remains AR3738, now approaching the western limb. It continues a slight decreasing trend, but remains magnetically complex with up to two delta regions present. The next largest region is AR3751, in the southeast. This spot continues to develop, gaining penumbra around the intermediate spot regions and now with a delta faintly visible near the leading portion of the spot. AR3744 and AR3748 near centre disk are both inherently less-stable north-south magnetically aligned spots, the former of which has a delta present in its southern portion. There are up to four new regions on the disk, three of which are rounding the eastern limb and a small region in the northwest. All other regions are considered to be relatively small and simple at present.

Despite the number and scale of solar flares, no Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar wind signal comprised variations on a slow regime, with a late enhancement noted, perhaps indicating a weak transient, SSBC or CH HSS. The solar wind speed was at background levels between 290-330km/s but rose to 360 km/s to end the period. The solar wind density was below average but became average from 15/1915 UTC. The interplanetary magnetic field (IMF), Bt, was weak, becoming moderate from 15/2150UTC, with a peak of 13nT. The north-south variation was also weak initially, becoming consistently negative and moderate after 15/2200 UTC reaching -10nT at 15/2341UTC. The phi angle was mostly positive (away from the Sun) but became negative (toward the sun) from 15/2135 UTC. The net result of the above solar wind measures was Quiet (Kp 1), until the final period where the provisional result was Unsettled (Kp 3).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at Background.

High energy electron flux (greater than 2MeV) observed by GOES16 was at Normal Background. The 24-hour fluence was below Active, with 1.15e6 integrated pfu observed at 16/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Further M-class flares are Likely with a slight chance of further X-class flares. The most likely candidate remains AR3738 but isolated flares are also possible from elsewhere on the disc. This risk abates slightly after midweek with the main sunspot group leaving the facing side of the Sun.

Solar Wind /Geomagnetic Activity: No Earth-directed CMEs feature in the forecast. A recent minor enhancement has been noted at L1. The only other potential enhancement currently possible is that of CH54/- later in the period, otherwise, solar winds should remain background. Geomagnetic activity is expected to be mostly Quiet, with a slight chance of G1/Minor storms early day 1 (16 Jul) due to the ongoing weak enhancement. Quiet conditions should then prevail,

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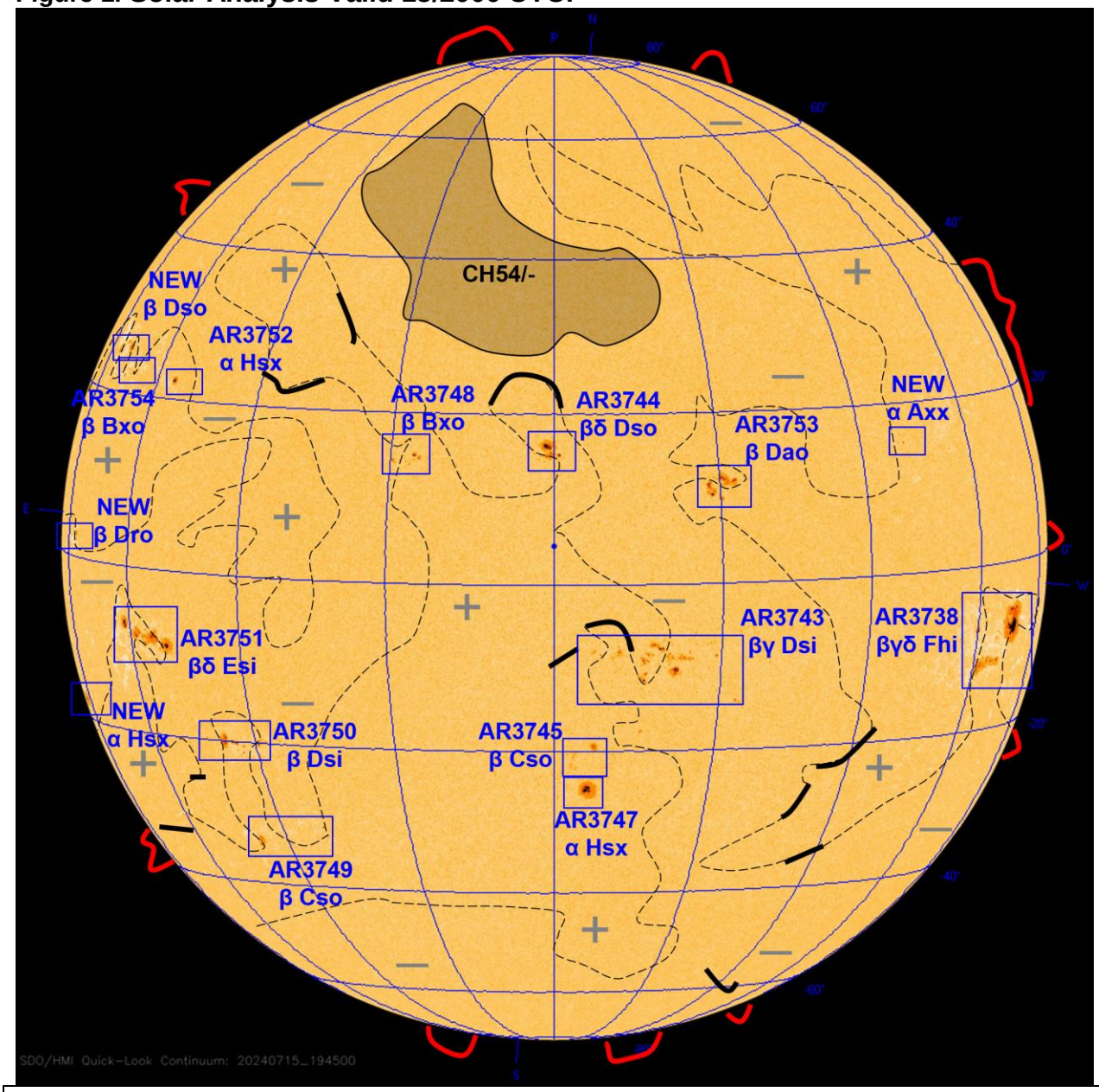
with a chance of Unsettled or Active spells and a slight chance of G1/Minor storms days 3 and 4 (18-19 Jul).

Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at Background levels, but with a Slight Chance of rising in response to any notable flares, mainly from AR3738.

The High energy electron flux is expected to remain at low / background levels. This may change should the onset of the fast wind originating from CH54/- occur around day 3 (18 July). Any uptick in fluence may be experienced from day 4 (19 Jul) onward, though the expectation is to remain below the Active threshold.

Figure 1. Solar Analysis Valid 15/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No CMEs feature in the forecast.

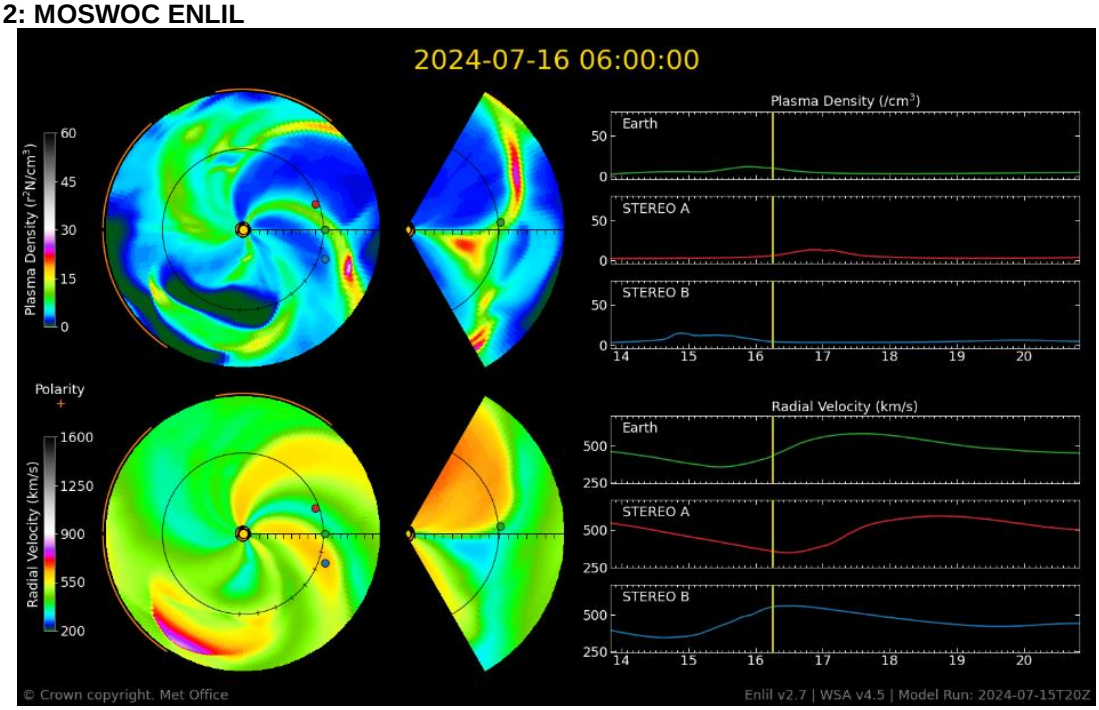
Solar winds are currently at background, though a recent weak enhancement has been noted. The fast wind from CH54/- is something of an unknown as, although it was present on the last rotation, it caused no notable effect on geomagnetic activity. It is likely too far north to interact with Earth, though due to it's size and apparent darkness, a token slight chance of a solar wind enhancement is catered for in days 3 and 4 (18-19 Jul).

MOSWOC Enlil is almost anti-phase compared to expectations and very likely overstated in terms of magnitude.

Geomagnetic activity is expected to be mostly Quiet, with a slight chance of G1/Minor storms early day 1 (16 Jul) due to the ongoing weak enhancement. Quiet conditions should then prevail, with a chance of Unsettled or Active spells and a slight chance of G1/Minor stroms days 3 and 4 (18-19 Jul).

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	10	1	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC ENLIL



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Radio Blackouts - X-Ray Flares:

Solar activity has been Moderate, with a triple-peak M2.7 flare at 15/0937 UTC originating from AR3738.

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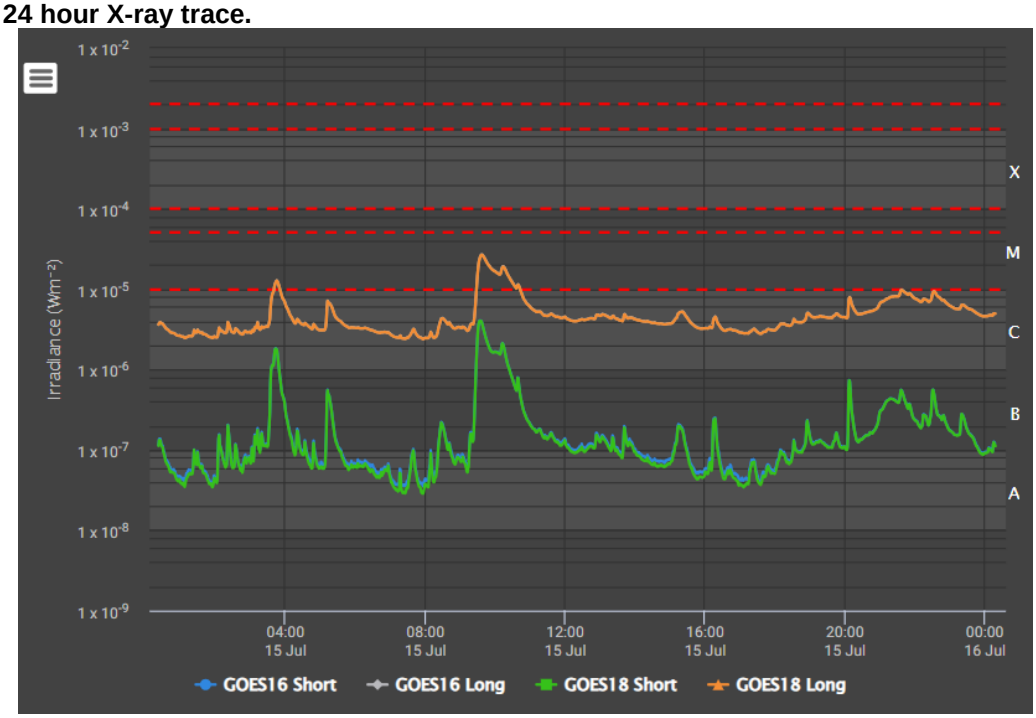
Further M-class flares are Expected with a Slight Chance of an isolated X-class flare. The most likely candidate remains AR3738 but isolated flares are also possible from elsewhere on the disc.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	70	70	60	60
Very Active	R3 to R5 X Class	No	10	10	5	5

Figure 3: 24 hour X-ray trace.



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux at GOES18 is at Background. There remains a daily Slight Chance of exceeding the S1/Minor radiation storm threshold should any significant flares occur, these perhaps most likely from AR3738 until day 3 (18 Jul) when it will have rotated completely around the southwestern limb.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	15	15	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

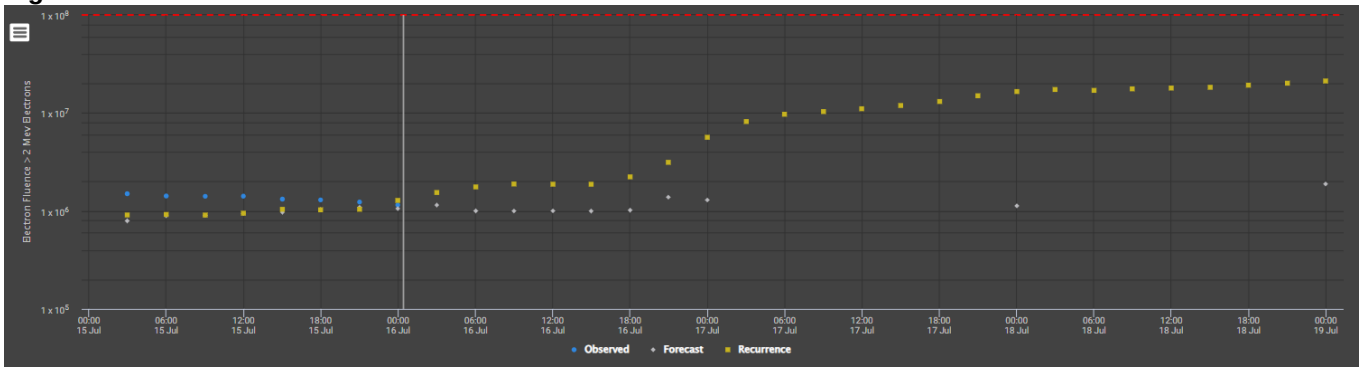
High Energy Electrons Event (≥ 2MeV):

There are no immediate sources of fast wind enhancements, the High energy electron flux is expected to remain at low / background levels. This may change should the onset of the fast wind originating from CH54/- occur, however this is due on or around day 3 (18 July) and therefore any uptick in fluence may be experienced from day 4 (19 Jul) onward, though the expectation is to remain below the Active threshold.

MOSWOC REFM runs are considered to be offering reasonable guidance in their continuing flat forecast trend.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REFM electron fluence forecast/observations/recurrence.



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